

TRIBHUVAN UNIVERSITY

Institute of Science and Technology

2067

Bachelor Level/ First Year/ First Semester/ Science

Computer Science and Information Technology (Stat. 103)

(Probability and Statistics)

Full Marks: 60

Pass marks: 24

Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.

All notations have the usual meanings.

Group A

Attempt any Two:

(2x10=20)

1. State Baye's Theorem.

In a certain assembly plant, three machines B_1 , B_2 , and B_3 make 30%, 45% and 25% respectively, of the product. It is known from past experience that 2%, 3% and 2% of the products made by each machine, respectively, are defective. If a product were chosen randomly and found to be defective, what is the probability that it was made by machine B_3 ?

2. (a) Explain point estimation and interval estimation. What are the criteria for good estimators?

(b) If $\bar{X} = 50$, $S = 15$, $n = 16$, and assuming that the population is normally distributed, estimate the standard error of the sample mean and estimate 99% confidence interval for the population mean μ .

3. (a) Define Karl Pearson's correlation coefficient and state its properties.

(b) The following table shows the production of coal and the number of wage earners in the coal industry over a ten year period during which the capital equipment has remained constant.

Output in tons (Y)	21	21	20	18	17	17	14	13
No. of Workers (X)	70	68	65	50	47	47	44	43

Determine the fitted regression line and predict Y for $X = 55$.

Group B

Answer any eight questions:

(8x5=40)

4. The following data represent the total fat for burgers from a sample of fast-food chains.

19 31 34 35 39 39 43

Compute mean, median and mode then describe the shape of the distribution.

5. What is axiomatic definition of probabilities and what are its properties?
6. If two random variables X_1 and X_2 have the joint probability density

$$f(x_1, x_2) = \begin{cases} \frac{2}{3}(x_1 + 2x_2), & \text{for } 0 < x_1 < 1, 0 < x_2 < 1 \\ 0, & \text{elsewhere} \end{cases}$$

Find the conditional density of X_1 given $X_2 = x_2$.

7. Prove that $\text{Var}(X + Y) = \text{Var}(X) + \text{Var}(Y) + 2 \text{Cov}(X, Y)$.
8. Find the first and second moments of binomial distribution and also compute variance for the binomial distribution.
9. Service calls come to a maintenance center according to a Poisson process and on the average 2.7 calls come per minute. Find the probability that no more than 4 calls come in any period.
10. In a photographic process, the developing time of prints may be looked upon as a random variable having the normal distribution with a mean of 16.28 seconds and a standard deviation of 0.12 second. Find the probability that it will take (i) anywhere from 16.00 to 16.50 seconds to develop one of the prints, (ii) at least 16.20 seconds to develop one of the prints.
11. Obtain the maximum likelihood estimate for mean (μ) and variance (σ^2) of the normal distribution.
12. Define canonical definition of t-distribution. Discuss some of its properties.
13. It is claimed that an automobile is driven on the average more than 20,000 kilometers per year. To test this claim, a random sample of 100 automobiles owners are asked to keep a record of the kilometers they travel. Would you agree with this claim if the random sample showed as average of 23,500 kilometers with a standard deviation of 3900 kilometers?